

56. On two New Actinians from the Coast of British Columbia. By J. PLAYFAIR McMURRICH, C.M.Z.S.

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The two forms described below were obtained during a visit to the Marine Station maintained by the Canadian Government at Departure Bay, Vancouver Island. They are of especial interest from the probability that they represent stages of a single species, and belong to a group that has not yet been described as occurring on the west coast of North America. Since the specific identity of the two forms is only a probability, it has seemed well to regard them for the present as distinct, and even, for reasons given below, to assign them provisionally to different genera.

PEACHIA QUINQUECAPITATA, sp. n. (Pl. XCVIII. figs. 1-4.)

This form (fig. 1) was dredged by Dr. C. McLean Fraser in Nanoose Bay, Vancouver Island, in 15-20 fathoms. In the majority of the individuals the base is depressed in the centre and smaller than the column. It is thin, and in all cases shows clearly the lines of insertion of the mesenteries as well-marked inversions, so that it can have possessed but very slight adhesive powers, if any. In one individual the attachments of the mesenteries did not quite reach the centre of the base, but ended abruptly a short distance from it, leaving a circular central area which was exceedingly thin, but nevertheless not perforated. In other examples this condition did not occur, the insertions of the mesenteries extending quite to the centre, so that there were no indications of a terminal pore, such as has been described by Gosse (1860) in *P. hastata*.

The column (fig. 1) is almost cylindrical, though usually contracting somewhat towards either extremity and, in some examples, is grooved by twelve well-marked inversions, although in others these are quite indistinct. Examined under a lens the surface is seen to be studded with minute elevations, which are all the more noticeable by being of a paler colour than the general surface. No foreign particles were adhering to these elevations in any of the examples studied, and, as I had no opportunity for examining living specimens, I cannot say whether they had the power of adhering to surfaces with which they came into contact, as seems to be the case with the similar

* For explanation of the Plate see p. 972.

structures of *P. hastata* (Haddon and Dixon, 1885) and *P. tri-capitata* (Andres, 1883).

There was no differentiation of the upper part of the column to form a capitulum, nor was there any distinct margin.

The tentacles are twelve in number, arranged in a single cycle. They are of moderate length and stoutness, obtuse or tapering slightly at the tips, but not capitate, and frequently with longitudinal grooves.

The lips are elevated considerably above the level of the disk, and show only a single siphonoglyph (fig. 2), which is completely separated from the rest of the stomatodæum by the fusion of its lips throughout the greater part of their extent. At least this was the case in three individuals that I examined anatomically, and it would seem, therefore, to be of general occurrence. Sedgwick (1884) has described the same peculiarity as occasional in *P. hastata*, but it is not mentioned by other authors who have studied the anatomy of that species (Haddon, 1885, 1889; Faurot, 1890, 1895).

The general surface of the stomatodæum is longitudinally grooved along the lines corresponding to the insertions of the mesenteries, and each lip is raised in the intervals between the grooves into five rounded elevations, which correspond with the intervals between the perfect mesenteries, with the exceptions of those between the directives. One of these latter is quite small and the other is represented by the margins of the siphonoglyph, which, although not elevated to any great extent beyond the rest of the lips, nevertheless bear fine tuberculiform or digitiform processes (figs. 2, 3) which correspond with the conchular lobes of other forms. Two of these processes form a pair lying one on either side of the more dorsal portion of the siphonoglyph opening and the three others are situated more ventrally, the median one being in the sagittal plane of the body, opposite the bottom of the siphonoglyph. In three individuals examined, of different sizes, I found no variation in the form or arrangement of these conchular processes, and would therefore conclude that this is their final adult arrangement.

Size.—The height of the column, measured in individuals preserved in formalin, was in the larger forms about 2.0 cm., the diameter at about the middle being about 0.9 cm., and at the limbus 0.6 cm. The length of the tentacles was 0.4 cm.

Colour.—Examples preserved in formalin retain a considerable amount of the original coloration, and from these it is possible to state that the general colour of the column is a more or less intense brownish red. In some cases it is distributed over the entire extent of the column and in others it is limited to the distal portion, the proximal or basal part being almost colourless. A closer examination shows that the pigment is not uniformly distributed throughout the area in which it occurs, but presents the appearance of a brownish red ground-colour upon which are scattered numerous minute dots of a paler shade, these

representing the small elevations already described as scattered over the entire surface of the column. The tentacles seem to have been of a paler colour than the upper part of the column and marked by four or five rings of a more or less intense brownish red (fig. 2). The conchular processes seem to have been of the deeper shade, with paler apices.

Structure.—The column mesoglea is much thicker than the ectoderm and is of a finely fibrillar structure, cells being scattered among the fibrils. There are no ectodermal muscles, but associated with the presence of ectodermal gland-cells there is a well-defined layer of nerve-fibres. The adhesive organs appear in sections as elevated areas of the ectoderm, composed of slender cells considerably longer than those of the adjacent ectoderm; the areas contain no gland-cells and, consequently, appear much paler than the general ectoderm in stained preparations. In structure, therefore, the organs differ from typical verrucæ only in being elevations of the surface instead of depressions. The endodermal musculature is supported on short simple processes, and towards the distal portion of the column it becomes weaker, the cells being arranged in an almost simple layer, and there is no indication of a sphincter.

The musculature of the tentacles and disk is very moderately developed, and there are no muscle-fibres on either the ectodermal or endodermal surface of the stomatodæum. The structure of the siphonoglyph is quite characteristic. Its ectoderm is much higher than that of the rest of the stomatodæum and destitute of gland-cells. The surface bears very numerous strong cilia and is provided with a distinct cuticular layer, beneath which the nuclei of the cells are arranged in very many layers, the basal portion of the epithelium containing but few, and appearing as if composed of a very fine reticulum, which is traversed by a band of nerve-fibres. The endoderm is also much higher than it is over the rest of the stomatodæum and its basal portion is also reticular in structure, though somewhat coarser than the ectoderm. The mesoglea also differs from that of the general stomatodæum, its ground-substance being almost homogeneous and assuming a clear blue tint with hæmatoxylin-erythrosin, while elsewhere the colour is decidedly violet. The fusion of the lips, mentioned above, is merely an epithelial union; indeed, it appears to be due to adhesion of the cuticular layers of the two adjacent surfaces.

The mesenteries are arranged in ten pairs, six of which are perfect, the remaining four pairs occupying the lateral and sulco-lateral interspaces. Of the perfect mesenteries, two pairs are directives, and all have well-developed diffuse muscle-pennons (fig. 4) consisting of strong though but slightly branched lamellæ. A well-marked parieto-basilar muscle is also present forming usually a slight fold. The reproductive cells could not be distinguished in the individuals examined, but the endoderm of the mesenteries in the region proximal to the

mesenterial filament is greatly thickened and very granular, as if from the presence of ingested food-material. The eight imperfect mesenteries are destitute of mesenterial filaments and, indeed, represent only the muscular portion of the perfect mesenteries. Their muscle-processes are but few in number and they do not possess any distinct parieto-basilar muscle. There is no difference in the development of the various perfect mesenteries such as Faurot has described for *P. hastata*; all are provided with mesenterial filaments and are alike in all particulars.

The first description of a form that may definitely be assigned to the genus *Peachia* is that furnished by Reid (1848) of a species washed ashore in the Bay of St. Andrews and named *Actinia cylindrica*. This name had, however, already been employed by Renier (1804) for *Cerianthus membranaceus*, and has therefore given place to the term *Peachia hastata*, proposed by Gosse (1855) for a form with which Reid's species is evidently identical. In the following year Koren and Danielssen described under the name *Siphonactinia boeckii* a form that is certainly congeneric with the *Peachia* of Gosse, and that author in 1860 described two additional members of the genus, *P. undata* and *P. triphylla*. No further additions to the list of species were made until 1879, when Hutton described as *P. carnea* a form cast up on the beach at Dunedin, New Zealand; a little later Andres (1883) described as *Siphonactinia tricapitata* a form from Naples that he had originally (1881) considered identical with Gosse's *P. triphylla*, and in 1893 I described *P. koreni* from off the coast of the Argentine Republic. There seems to be no room for doubt as to the distinctness of *P. quinquecapitata* from *P. hastata*: the form of the conchula, the equality of all the perfect mesenteries, and the feebler development of the longitudinal musculature of the imperfect ones furnish sufficient bases for their separation, independently of their coloration and geographical distribution. *P. koreni*, with only eight tentacles and a simple conchula, may also be regarded as distinct, and although the description of *P. carnea* is very incomplete, its geographical distribution is *prima facie* evidence of its distinctness also.

With regard to the remaining four species, all of which are European, the evidence is not so clear, since no anatomical data concerning them are available. *P. undata*, from the Channel Islands, is believed by Haddon (1889) and G. Y. & A. F. Dixon (1891) to be merely a young example of *P. hastata*, its conchula resembling that of immature examples of the latter species. *P. triphylla*, also from the Channel Islands and the Firth of Clyde (Robertson, 1869, 1875), on the other hand, has a conchula composed of three lamellar processes, and in this resembles *P. boeckii*; the latter, however, bearing the lamellæ upon the summit of a tubular prolongation of the siphonoglyph, whereas in Gosse's figure of *P. triphylla* they are represented as sessile. The difference may, however, be due to a difference in contraction,

and it is not improbable that the two forms are identical. It must be noted, however, that Faurot (1895) identifies *P. boeckii* with *P. hastata*, and until anatomical data are furnished it will be well to regard it as a distinct form. Finally, in the Mediterranean *P. tricapitata* the conchula is composed of tubercles; and while the correctness of its original identification by Andres (1881) with *P. triphylla* must still be regarded as a possibility, it seems advisable for the present to regard it as a good species.

A provisional arrangement of the known species of *Peachia* may then be stated thus:—

Tentacles 12.	
Conchular lobes 6-20, irregular	<i>P. hastata</i> .
Conchular lobes 3, lamellar,	
sessile	<i>P. triphylla</i> .
borne on tubular prolongation of siphonoglyph	<i>P. boeckii</i> .
Conchular lobes tuberculariform,	
three in number	<i>P. tricapitata</i> .
five in number	<i>P. quinquecapitata</i> .
?	<i>P. carnea</i> .
Tentacles 8	<i>P. koreni</i> .

BICIDIUM ÆQUOREÆ, sp. n. (Pl. XCVIII. figs. 5-7.)

This form is not uncommon as a parasite upon the bell of the *Leptomedusa Equorea forskalii*, which is of very common occurrence in the waters of British Columbia. The column (fig. 5) has a rounded base, is somewhat conical or urn-shaped and wrinkled transversely by contraction in examples preserved in formalin. Proximally it usually shows some faint longitudinal grooves which mark the lines of insertion of mesenteries, but no signs of verrucæ or other adhesive organs could be seen. The margin, which is indistinct, is occupied by a single series of twelve short and obtuse tentacles. The mouth (fig. 6) is usually widely expanded, so as to completely hide the disk, and shows a single siphonoglyph; no conchula was present.

Size.—Length about 7 mm., greatest diameter 4 mm.

Colour.—There was no trace of colour in any of the examples seen.

Structure.—The column mesogloea is thinner than either the ectoderm or endoderm and has a homogeneous or finely fibrillar structure, cells being scattered throughout the ground-substance. The ectoderm is of uniform structure throughout its entire extent, no verrucal areas being distinguishable. There are no ectodermal muscle-fibres, and those of the endodermal surface are arranged in a simple layer, there being no mesogloæal lamellæ for their support and no indications of a sphincter muscle. The musculature of the tentacles is also very feeble, the ectodermal fibres being arranged in a single uniform layer, while the endodermal ones are hardly distinguishable.

The single siphonoglyph is prolonged somewhat below the level

of the rest of the stomatodæum and forms a well-marked deep groove, whose endoderm is much higher than that of the rest of the stomatodæum, although it does not present a reticular formation such as occurs in *Peachia quinquecapitata*. There are six pairs of mesenteries, all of which are perfect and all possess mesenterial filaments; no indications of additional mesenteries of the second cycle were to be found. Two of the six pairs were directives. The longitudinal musculature (fig. 7) formed a low pennon extending throughout the entire muscular area of the mesentery, the supporting lamellæ being palisade-like in their arrangement, and is higher than the endoderm that covered them. No parieto-basilar muscle was present in my preparations, which did not, however, include the most proximal portion of the column.

A number of immature Actinians, a list of which has been given by Haddon (1887), have been described as parasites in various species of Medusæ, and all present structural features sufficiently similar to suggest that they are generically identical with one another and with the form described above. They have been assigned in part to the genus *Halcampa* and in part to *Peachia*, but none of these has yet been actually shown to transform into the one or the other of these genera, and until the adult condition is definitely known it seems well to retain for them the genus *Bicidium* established by L. Agassiz (1859), recognizing, however, that this is but provisional and that the forms assigned to it are larval or at least immature.

The evidence furnished by the structure, although not conclusive, does however give some indications of the probable position of the adult form and, I believe, points towards the genus *Peachia*, rather than to *Halcampa*. Differences between the two genera that are pertinent to this question are to be found in the presence of a conchula in *Peachia* and its absence in *Halcampa*; in the single deep siphonoglyph of *Peachia* as compared with the two shallow ones of *Halcampa*; and in the somewhat diffuse form of the muscle pennons in *Peachia* as compared with the compact and circumscribed ones of *Halcampa*. The first of these differences is not apparent in all species of *Bicidium*, the conchula probably being late in its development, but the other characteristics are constant in all known forms whose anatomy has been recorded.

Since Haddon (1887) reviewed the various species of *Bicidium* some additions have been made to our knowledge of them, and in support of my contention as to their affinities to *Peachia* rather than to *Halcampa*, a reconsideration of them may not be amiss. The absence of a conchula in *B. æquoræ* is, it is true, opposed to its reference to *Peachia*, but, as has been pointed out, this structure may very well be late in developing, and in the nature of the siphonoglyph and the muscle pennons the similarity to that form and the difference from *Halcampa* are pronounced.

The occurrence of *P. quinquecapitata* in the same locality is also suggestive, but the differences between the two forms are too marked to warrant their identification, although it is not improbable that these differences are due to age rather than specific differences.

The structure of *Actinia clavus* of Quoy and Gaimard (1833), recently studied by Pax (1912), shows, I believe, that it must be considered congeneric with *B. equorea*, although Pax refers it to the genus *Halcampa*. As in the British Columbian species, there are no indications of a conchula; but again, the form of the siphonoglyph and the muscle pennons suggest *Peachia* rather than *Halcampa*, and until further evidence as to its exact position is available, it would seem well that it should be known as *Bicidium clavus*.*

The evidence as to the affinities of *B. parasiticum* is more definite. It was first described by L. Agassiz (1859) from *Cyanea arctica* and later by Verrill (1864), who showed that it possessed a well-marked trilobed conchula, and, still later (1866), assigned it to the genus *Peachia*. Preparations that I have of this species show it to have a striking general similarity to *B. equorea*, the mesenteries being twelve in number, all perfect and all bearing mesenterial filaments, and the siphonoglyph single and deep. The muscle pennons also are of the same diffuse type, but the lamellæ (fig. 8) are not arranged in the manner of a palisade, but are decidedly branched in a dendritic manner so that they present an appearance of being arranged in groups. It is to be noted that Verrill (1874) mentions the capture of two very large examples of this species, imbedded in gravel at low-water mark at Eastport, Maine; he does not, however, give any anatomical data concerning them, and until it is definitely known that the form develops the four pairs of secondary mesenteries (zygocnemes), it seems advisable to allow it to remain in the genus *Bicidium*.

The form which F. Müller (1860) described very completely as *Philomedusa vogtii* is also undoubtedly a *Bicidium*. It occurred upon the medusæ *Olindias* and *Chrysaora* and was provided with a trilobed conchula, twelve tentacles, twelve mesenteries, all of which were perfect and furnished with mesenterial filaments, and had a single siphonoglyph. The form described by Graeffe (1884)

* The observations of Pax make it quite certain that R. Hertwig (1882) was in error in identifying a *Halcampa* from the Kerguelen Islands with Quoy and Gaimard's species. The possibility of Hertwig's forms being young examples of Studer's *Edwardisia kerguelensis*, which Kwietniewski (1896) has shown to be a Halcampid, should not be lost sight of, although the differences in the descriptions as they stand are too great to permit of a definite identification. Furthermore, the contention of Pax that the *H. clavus* of Tizard and Murray (1881) and Appellöf (1897) is distinct from that described by Hertwig is undoubtedly correct, but since the forms so named by Appellöf were the actual types of Danielsen's *Halcampoides abyssorum*, it is difficult to understand the necessity for the new name, *septentrionalis*, that Pax bestows upon them.

as *Halcampa medusophila*, occurring on various medusæ (*Tima*, *Octorchis*, and *Equorea*) is probably identical with Müller's species, the absence of a conchula being probably due to its greater immaturity.

In 1860 Wright described as *Peachia fultoni** a form that he found parasitic on a species of *Thaumantias* (*Phialidium*?), later (1861) changing its name to *Halcampa fultoni*. This is probably the same as the form described by Haddon (1887), and erroneously, as has been pointed out by Carlgren (1904), regarded by that author as the larva of *Halcampa chrysanthellum*. In 1887, McIntosh recorded the occurrence of actinian larvæ on various Thaumantiad medusæ occurring at St. Andrews, identifying them as the young of *P. hastata*, an opinion in which Haddon (1888) concurred after an examination of their structure, still maintaining, however, their distinctness from the examples previously described as the young of *H. chrysanthellum*. They possessed eight tentacles and eight large mesenteries together with four smaller deuteroecemic ones. It may be that Haddon is correct in regarding the two forms he examined as distinct species, but even if so it seems clear that they are to be referred to the same genus, and since it is still uncertain that they actually do develop into *Peachia*, it will be preferable to place them in *Bicidium*.

Finally, Dendy (1888) has described from medusæ obtained at Port Philip a parasitic actinian with twelve tentacles, within which there was "an inner circle of 12 cushion-like swellings," which in older individuals become saccular outgrowths. It is not possible to ascertain from Dendy's account, whether or not these outgrowths represent a conchula, and the exact affinities of the form must remain doubtful, although with a probability that it represents a *Peachia*†.

The available evidence seems, accordingly, to point strongly in favour of these various medusophilous forms being young stages in the development of *Peachia* rather than *Halcampa*, but a direct linking up of the immature examples of *Bicidium* with their respective adults is necessary to settle the question.

* Some confusion exists in the references to the literature of this species. Andres (1883) gives the date of its first description as 1859 and as references the Proceedings of the Physical Society of Edinburgh, vol. ii. 1859, and the New Edinburgh Philosophical Journal, vol. xii. 1860. Haddon (1887) repeats the latter reference but substitutes for the former, Proceedings of the Royal Society of Edinburgh, vol. ii. 1860. There is no paper in the Proceedings of the Royal Society of Edinburgh by Wright referring to this species, and the date of vol. ii. of the Proceedings of the Royal Physical Society of Edinburgh, which does contain such a paper, is 1861 and not 1859. The reference to the Edinburgh New Philosophical Journal (this being its correct title) should read "New Series, vol. xii. 1860."

† Carlgren (1904) mentions, without descriptions or names, two additional forms that should probably be referred to this genus, one occurring in the medusa *Eutimalphes indicans* on the Swedish coast and the other on a large medusa from Valparaiso.

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EXPLANATION OF PLATE XCVIII.

Fig. 1. *Peachia quinquecapitata*. Nat. size.

2. Oral view of *P. quinquecapitata* expanded. $\times 2^1$
3. Oral view of partially contracted individual of *P. quinquecapitata*, showing arrangement of conchular lobes.
4. Transverse sections of mesenteries of *P. quinquecapitata*.
5. Side view of individual of *Bicidium æquorea*. $\times 4$.
6. Oral surface of *B. æquorea*. $\times 4$.
7. Transverse sections of mesenteries of *B. æquorea*.
8. Transverse sections of mesenteries of *B. parasiticum*.